

ORIGINAL



## SOUTHWEST GAS CORPORATION



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AZ CORP COMMISSION  
DOCKET CONTROL

March 31, 2016

Docket Control  
Arizona Corporation Commission  
1200 West Washington Street  
Phoenix, AZ 85007-2996

Re: **Docket No. G-01551A-04-0876; Decision No. 68487**

Pursuant to Commission Decision No. 68487, Southwest Gas Corporation (Southwest Gas) hereby submits for filing an original and thirteen copies of Southwest Gas' Arizona Research 2015 Summary Report and 2016 Plan.

Finding of Fact No. 37 of the Decision states, "Gas Research should be funded at the level recommended by Staff, but Southwest Gas should have the flexibility, subject to Staff oversight, to select appropriate entities for use of the research funds." The submitted Plan provides a list and description of the research programs to be funded by Southwest Gas between April 2016 and March 2017 and includes projects funded between April 2015 and March 2016.

Representatives from Southwest Gas met with Utilities Division Staff to provide a general update on Southwest Gas' R&D activities over the past year and planned projects for the upcoming year.

If you have any questions or require additional information, please contact me at 602-395-4058.

Respectfully submitted,

Matthew D. Derr  
Regulatory Manager/Arizona

Arizona Corporation Commission

**DOCKETED**

MAR 31 2016

Cc: Tom Broderick, ACC Utilities Division  
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**Southwest Gas Arizona Research  
2015 Summary Report & 2016 Plan  
April 1, 2016**

Description	Apr. '15 - Mar. '16 Funding
ACC approved Research and Development funding	\$688,712
Operational Technology Development (OTD)	\$ 399,156
-OTD Annual fee \$330,155	
-Supplemental OTD funding \$69,001	
NYSEARCH	\$ 70,376
-Annual fee \$44,021	
-Ref. No 32- Emissions Quantification Test Program \$10,393	
-Ref. No 33- Hardness Testing – Feasibility Study with Robotic Platform – Phase II \$15,962	
Other	\$ 219,180
-Ref. No 38- Temperature Study \$76,991	
-Ref. No 39 Joint Industry Project (JIP)- Improved In-Situ Determination of Pipe and Weld Properties \$14,161	
-Ref. No 40- Keyhole Tool \$17,976	
-Ref. No 41- Picarro Surveyor \$110,052	
<b>Total Dollars Allocated</b>	<b>\$ 688,712</b>
<b>Available Dollars</b>	<b>\$ -</b>

Description	Apr. '16 - Mar. '17 Funding
ACC approved Research and Development funding	\$688,712
Operational Technology Development (OTD)	\$ 330,155
-OTD Annual fee \$330,155	
NYSEARCH	\$ 191,690
-Annual fee \$44,021	
-Ref. No 32- Emissions Quantification Test Program \$28,188	
- Ref. No 34- Design, Construction and Testing of Magnetic Flux Leakage (MFL) Sensor for Inspection of Bends in Unpiggable Pipelines - Phase VII-b \$43,254	
-Ref. No 35- Odor Detection Threshold Study \$24,872	
-Ref No. 36 Standoff Gas Flow Imaging and Analysis System Proof of Concept \$38,691	
-Ref No 37- Development & Testing of RFID Tag for Coiled PE Pipe \$12,664	
Other	\$ 47,690
-Ref. No 38- Temperature Study \$47,690	
<b>Total Dollars Allocated</b>	<b>\$ 569,535</b>
<b>Available Dollars</b>	<b>\$ 119,177</b>

Note: Southwest anticipates using all available dollars as appropriate R&D project proposals are received.

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**Southwest Gas Arizona Research  
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Ref. No	Organization/Project Name	Research Performer	Project Description	Potential Benefits to AZ Customers	Status	Apr. '15 - Mar. '16 Funding	Apr. '16 - Mar. '17 Funding
7	(3.14.a) Soil Compaction Supervisor Enhancements	GTI/MBW Inc.	Upgrade the capabilities of the Soil Compaction Supervisor (SCS) to make it compatible with modern information systems and data capture practices as well as more user friendly through better data logging and reporting capabilities. Initial efforts will also be investigated to determine the SCS's ability to be correlated to a standard proctor value or range.	This project has safety and economic benefits:  Ensure that compaction is being performed properly (quality control) and enabling a utility to validate proper compaction.	GTI worked with MBW to design a Windows-based interface that is acceptable to the utilities and allows for easy data transfer in a database-ready format. Having this user interface allows the users to review data both immediately in the field as well as in the back office, providing the opportunity for further analysis. The application was built according to the specifications of the SCS demo prototype; the final prototype was not available during the course of this work. There is potential for further application development once the prototype is finalized. The Windows-based application has been demonstrated to the project sponsors and to MBW for consideration in future development.	\$2,622	\$1,762
8	(4.13.c.2) Pipeline and Hazardous Materials Safety Administration (PHMSA) Electro-Magnetic Acoustic Transducer (EMAT) Sensor for Small Diameter and Unpigable Pipe Phase 2 Construct and test field ready prototype	GTI	Build and test an EMAT sensor prototype to detect and quantify wall loss and longitudinal cracks in metallic pipes. The sensor will be used to assess small-diameter and unpigable pipes containing fittings and other restricting features.	This project has safety and economic benefits:  Reduce the cost of retesting pipelines that have been using historic operating pressure to establish Maximum Allowable Operating Pressure (MAOP).	Develop a bi-directional EMAT sensor that can be used to assess small diameter and unpigable pipelines containing reduced diameter fittings and other restricting features. Phase 2 focuses on constructing and testing the field-ready prototype based on the bench-scale prototype sensor that was successfully developed and tested in Phase 1.	\$7,337	\$7,337
9	(4.13.d) Hydro-Testing Alternative Program - Phase 3	GTI	This project is the third phase of the program to identify and validate inspection and assessment technologies that are equivalent to a 1.25x MAOP hydro-test for the proposed Integrity Verification Process (IVP) compliance.	This project has safety and economic benefits:  Reduce the cost of retesting pipelines that have been using historic operating pressure to establish MAOP.	The work in phase 2 created the Finite Element Analysis (FEA) critical flaw data and collected Probability of Detection (POD) data for EMAT and Acoustic Resonance Technology (ART) sensors. Phase 3 will create the critical flaw curves to allow a comparison to In-Line Inspection (ILI) tool detection capabilities. The deliverable of Phase 3 will be a tool that operators can potentially use to demonstrate equivalence to a hydrotest for a specific pipe segment. American Gas Association (AGA) and/or the appropriate standards organizations will be consulted to implement the results of this project.	\$4,294	
10	(4.14.c) Surface Indentation for Material Characterization Correlation of Surface Properties Based on Vintage	GTI	Develop correlation factors to relate surface properties to actual material properties to allow surface indentation techniques to be used for material property validation for pipelines. The correlation factors will be based on pipe vintage by decade.	This project has safety and economic benefits:  Reduce the cost in determining the pipe material properties (e.g., strength) of steel pipe for pipeline integrity purposes.	Past research has proven the ability of surface indentation techniques such as stress-strain microprobes and hardness testing to accurately determine material properties of pipes within a localized area, but variations in material properties through the wall are problematic for local interrogation techniques. Probabilistic confidence intervals will be developed to allow operators to use surface indentation techniques by applying correlation factors to pipe materials that may have through-wall variability.	\$6,922	
11	(4.15.a) Field Ready Butt Fusion Inspector Phase 2a (2b)	GTI	Provide a portable and field-hardened ultrasonic tool to reliably inspect PE butt fusion joints in a field environment. The device must require the operator to understand or interpret ultrasonic waveforms; yet ultimately provide a good or bad output indicator. The tool must require little or no field calibration, however it may require a verification standard to confirm proper device functionality.	This project has safety and economic benefits:  Enhancement of fusion execution for better consistency in performance.	Work in phase 2 is underway. The project sponsors were surveyed and 8-inch high density polyethylene (PE) pipe was selected as the pipe for development of the first prototype system. The design and construction of the prototype electronics have been initiated. The software to collect and process data is being developed. A list of butt fusion joints needed for calibration has been developed.	\$3,669	\$3,440
12	(5.14.a) Radio-Frequency Identification (RFID) Testing Program	GTI	To conduct a testing program to compare the performance and features of multiple RFID tag solutions for locating and tracking underground assets.	This project has a safety benefit:  Enhancement of locating and tracking natural gas underground assets.	RFID tag installations were completed for the 3M Marker Ball, the Benetton Infra Marker, and the Elliot Marker System. Programming of tags, along with user experience and impressions, were recorded. Assets targeted for RFID tagging included a mix of steel and PE systems from existing pipe test beds in addition to available utility hook-ups (gas, electric, and water). The project team is in the process of locating, reading, and testing all installed above and below ground tags.	\$2,514	
13	(5.14.d.2a) Tracking and Traceability for Transmission-Phase 2a Standards for Mill Test Reports (MTR) and Coating Reports, Rev	GTI	Develop standards, guidelines, and technology for tracking and traceability of transmission pipe. The results of this project will provide the industry with a standardized approach for capturing pipe, appurtenance, welding and coating data. Phase 2a will create standardized forms for MTR and factory applied coating information.	This project has a safety benefit:  Improved tracking of transmission pipeline information for integrity management.	Phase 1 identified data collection requirements, developed barcode labeling specifications, and created a design document for field data collection software. Phase 2a will create standardized forms for MTR and factory applied coating information.	\$3,353	



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14	(5.14.d.3) Tracking and Traceability Welding Traceability Phase 3	GTI	Develop field processes and a software application capable of recording quality control information to properly document the welding processes common to steel gas transmission line. The project will address welder qualifications, weld procedure qualifications, filler metal control, and the essential variables defined for each weld procedure used in the field.	This project has a safety benefit: Improved tracking of transmission pipeline information for integrity management.	The program results will provide the industry with a standardized approach for capturing pipe, appurtenance, welding and coating data. The initial effort in phase 3 included aligning the planned software architecture with the data collection software currently under development in phase 2b for manufacturer information. The next step is to create a mobile application based on open standards. An advantage to this approach is that the application users will have access to both data collection workflows within the same tool.	\$3,669	\$3,239
15	(5.14.n.2) Construction Compliance Monitoring System Ph2	GTI	Develop and test a risk, compliance and cost management solution - Risk and Compliance Assurance (RCA), including design objectives.	This project has a safety benefit: Improved tracking of field inspection for integrity management.	Phase 2 will build upon the success of the Phase 1 to produce an enhanced software and implementation blueprint for the Construction Compliance Monitoring (CCM) system. The CCM solution developed for Phase 1 demonstrated the effectiveness of this system and approach. Phase 2 seeks to enhance the effectiveness of this solution in four key areas: 1) Refine implementation and integration with company processes and systems, 2) Incorporate knowledge management tools within the inspection tablets, 3) Extend RCA into other operations activities, and 4) Enhance the application of statistical tools.	\$7,337	\$7,337
16	(5.14.t) Methods to Detect Inserted Plastic in Steel Mains	GTI	To identify field-friendly methods to determine if a steel main is plastic inserted. The method needs to be external and not require a high level of training. If commercial devices are identified, initial feasibility testing of these will be performed.	This project has safety and economic benefits: Improved accuracy in pinpointing hard to find plastic pipe inserted in steel main. In addition, reduced costs and increased safety in operating distribution pipelines installed using the insertion method (inside steel main).	Identify field-friendly methods to determine if a steel main is plastic inserted to provide tool to increase safety in the field. The method needs to be external and not require a high level of training. If commercial devices are identified, initial feasibility testing of these will be performed.	\$448	
17	(5.15.a) Cybersecurity Collaborative	GTI	Create a multi-year program between natural gas distribution companies and the Department of Homeland Security (DHS) to address the high priority cybersecurity issues of participating members through a focused outreach and education process and a technology evaluation and transfer initiative.	This project has a safety benefit: Reduce the risk of any cyber-attack to distribution system.	Two (2) workshops were held with DHS and the sponsors to review and identify a list of potential projects to investigate further. Proposals have been prepared for three of the technologies and the sponsors are deciding which ones to develop further.	\$11,006	\$11,006
18	(5.15.c) Review and Gap Analysis of PE Access Fittings	GTI	Review currently available PE access fittings that allow entry into a live gas main, and perform a gap analysis with respect to gas utilities' needs. Based on those needs, to develop initial design/requirements of PE access fitting.	This project has a safety benefit: The access fitting allows for the use of camera and line locating tools which will have an impact to reduced excavation and restoration costs.	Fourteen (14) existing fittings that are currently on the market that are similar to the desired specifications were identified. They consist of nine "access" fittings and five transition fittings that have similar characteristics to access fittings. None of these access fittings satisfy all of the desired specifications of the sponsors and, therefore, further design work in conjunction with the manufacturer may need to be done. Final Report is being prepared.	\$11,006	
19	(5.15.d) Development of a Tee Helmet for Fitting Protection	GTI	Develop a "tee helmet" to protect various fittings (i.e., plastic service tees) from accidental strikes during construction excavation, which can result in damage to the tee and cause a subsequent leak.	This project has a safety benefit: Enhanced the protection of service tees and reduce third party damage.	A conceptual design will initially be developed and if approved, an alpha prototype will be developed.	\$3,669	\$3,283
20	(5.15.e) Evaluate Inspection Alert Tag for Critical Equipment	GTI	Evaluate technologies for a rugged electronic tag that can be attached to a fire extinguisher and possibly other devices used by utility crews to alert personnel when inspections or calibrations are due.	This project has safety and economic benefits: Enhanced the tracking of inspections and/or calibrations of items used by field crews.	Input was solicited from the sponsors, and at least two companies were identified that provide software for the tracking of inspections based on a barcode or electronic identification affixed to the item. The project team is preparing to test one of the systems. The system can scan barcodes (optical or electronic) attached to specific assets and provide an operator with the inspection status of the asset.	\$3,669	\$3,669
21	(5.15.f) No Stub Service Lateral Retirement	GTI	To develop a method of retiring a gas service or other lateral type fittings without leaving an extended stub on the gas main.	This project has safety and economic benefits: The development of such a tool and process will mitigate the potential for 3rd party damage during future excavations.	A sponsor survey identified the types and sizes of fittings to examine. The project team is obtaining a Japanese developed machine for evaluation. The manufacturer is making modifications to the equipment to allow for English units and compatibility with U.S. tee sizes.	\$3,669	\$2,523
22	(5.15.m) Mobile Technology Evaluation Program	GTI	Create a program for evaluating and rating new field hardware (tablet and hardened smart phone devices) that gas utilities can use for field data collection.	This project has an economic benefit: Enhance the selection process of mobile field devices.	The program will be systematic and will provide utilities quantitative and qualitative results for purchasing field data collection hardware. A prioritized set of use cases has been developed with the sponsors to guide the work.	\$7,337	\$7,337



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23	(5.16.f) Improved Safe Excavation Productivity for Locating Buried Utilities	GTI	Improve the effectiveness of safe vacuum excavation with compressed air to equal the productivity of hydro excavation.	This project has safety and economic benefits: Reduced excavation and restoration costs.	<i>This project has recently been initiated. A vacuum excavation partner is being brought onto the team through a subcontract and a survey is being developed for the sponsors about their use of the vacuum-type tools.</i>		\$3,669
24	(5.16.g) Enhancement of the Dynamic Cone Penetrometer (DCP) Compaction Device	GTI	Enhance the current DCP commercial device for acceptance and use for compaction measurements of backfills in place of the Nuclear Density Gauge (NDG).	This project has an economic benefit: Ensure that compaction is being performed properly (quality control) and enabling a utility to validate proper compaction.	<i>The initial step in the project involves discussing the key data needs with the sponsors. The data control unit will be modernized and functionality of the global positioning system (GPS) location and wireless data management and transfer will be improved.</i>		\$3,669
25	(6.06.a) Keyhole Project	GTI	Keyhole technology provides access to buried pipelines through a hole approximately 18" in diameter. This small size has many advantages including lower excavation costs, fewer required resources as well as minimal impact and restoration to pavement. This program evaluates and demonstrates new applications for keyhole technology.	This project has an economic benefit: Reduced excavation and restoration costs.	<i>The Keyhole Program held its recent biannual workshop for all members. Utilities and manufacturers shared the latest information related to keyhole topics ranging from mains and services replacement programs, corrosion protection, the municipal and regional process approval. A number of new technologies were demonstrated at the workshop. Plans are being developed for the next workshop and host site is being sought.</i>	\$7,337	\$7,337
26	(6.08.a) Carbon Management Information Center (CMIC)	GTI	To collaborate with members from natural gas and propane companies to address industry issues and opportunities in the evolving arena of source efficiency and gas emissions.	This project has an economic benefit: Better understanding of the role of natural gas end-use equipment in reducing overall energy use.	<i>Contribute to the progress of U.S. green building practices and rating systems by providing credible and unbiased technical data regarding the benefits of source energy in reducing energy consumption and carbon emissions. Through the CMIC program, technical experts are directly involved in technical committees and public review processes on full-fuel-cycle analysis and bringing greater awareness to the many ways the direct use of natural gas can improve source energy efficiency, reduce greenhouse gas emissions and lower energy costs for consumers. This program provides operators and builders with full information on full fuel cycle efficiencies and carbon dioxide (CO2) emissions.</i>	\$11,006	\$11,006
27	(6.11.a) Pipeline Research Council International (PRCI) Membership	GTI	Membership in the PRCI program and full participation in their technical committees through GTI's OTD.	This project has an economic benefit: Provide more access to research materials that OTD and NYSEARCH have not addressed.	<i>PRCI funders review and select the projects of interest to fund from these 7 committees: Corrosion; Design, Materials, and Construction; Integrity and Inspection; Surveillance, Operations, and Monitoring; Compressor and Pump Station; Measurement; and underground Storage. OTD has access to PRCI's library of reports and software. Currently ideas for proposals for 2017 are being identified and reviewed.</i>	\$7,337	\$7,337
28	(7.15.b) Remote Gas Sensing and Monitoring	GTI	To create a device to remotely monitor the level of gases during emergency situations. The device will provide critical information to first responders and gas company personnel, allowing them to determine the concentration of methane, carbon monoxide, and possibly other key indicators inside buildings, sewers, and other structures from a safe distance.	This project has a safety benefit: Provide critical information to first responders and gas company personnel during emergency situations.	<i>Ongoing Phase 1 is developing a system to allow a leak investigator to monitor methane levels at multiple points within a site under investigation. The investigator uses a tablet or phone to see the gas values in real time. Phase 2 will develop an unattended methane monitoring device. This monitor would be placed in the vicinity of a suspected (or recently repaired) leak to provide 24 to 48 hours of unattended monitoring. Placement of the device would be at the discretion of the investigator, determined by the hazards at a particular site.</i>	\$3,669	\$5,221
29	(8.16.a) Intelligent Field Data Collection Platforms	GTI	Improve the accuracy, consistency, completeness, and relevancy of datasets by leveraging recent and emerging field-based technology advances and incorporating lessons learned from previous generations of field-based applications. This "Smart Form" development effort will focus on compliance, utility asset, and key risk-related datasets.	This project has an economic benefit: Enhance the data collection from field installations.	<i>GTI will develop a fully functional prototype system for testing and demonstrating a specific use case for:</i> <ul style="list-style-type: none"><li>- Field Personnel Best Practices and Training</li><li>- Audit and Inspection of Field Operations</li><li>- Field Based Leak Management</li><li>- Exposed Pipe Inspections</li></ul>		\$3,669
30	(8.16.b) Remote Quality Assurance/Quality Control: Fusion Inspection and Reporting	GTI	GTI will develop a process, visualization, and reporting capability to support both operator as well as code regulations related to field based inspections. The use case for the system will be focused on the capture of plastic fusion related data and required inspections.	This project has an operational benefit: Assist in increasing the inspection requirements, data recording, and reporting of plastic fusions being performed by field personnel.	<i>GTI will develop a fully functional prototype system for testing in a pilot project as well as initiate commercialization of the prototype system.</i>		\$3,669



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31	(9.16.a) Determining Data Quality Implication	GTI	To develop a methodology, implementation protocols, and case studies.	This project has a safety benefit:  Enhance data quality, which is essential for proper risk analysis that will be used to support management decisions. These decisions are related to pipeline integrity programs.	A methodology, implementation protocols, and case studies will be developed which will allow the operators to: 1) construct a pedigree (i.e., data source and quality) analysis of their pipeline system database quantifying gaps, consistencies, default value rationale, etc. 2) calculate a "Health Index" parameter on their database entries at the individual data point and roll up to pipeline segment level and 3) facilitate Risk Management activities by demonstrating how the Health Index can be used to prioritize preventive and mitigative measures, data collection, risk ranking, and unknown threat determination.		\$7,337
						\$504,211	\$370,651
						OTD Balance Available	OTD Balance Available
						-\$124,490	-\$164,986
<b>NYSEARCH</b>							
<b>NYSEARCH Membership Dues</b>						\$44,021	\$44,021
32	Emissions Quantification Test Program (M2014-004 Phase IIIa/IIIb)	NYSEARCH	The project is intended to ensure that new technologies that are being applied to quantify methane emissions from handheld, mobile or aerial platforms can be properly validated for application in the complex gas distribution environment, particularly those systems in urban and/or congested areas.	This project has an economic benefit:  This will assist in prioritizing the repair of grade 3 leaks by their rate of emission and this leak rate information can also be used in prioritizing segments for main replacement programs.	A controlled tests were completed and the results/analysis were discussed and finalized. From that work, the data that was acquired from the three selected technology service providers showed that there was too much variability in the actual vs measured emissions rates and that we needed to collect more data and separate the results into bins of very low flow rate, low flow, medium and high flow rate. With the independent statistician showing this variability in terms of accuracy and precision, the funding group decided that we could not proceed to live field tests, but instead asked for a second round of controlled testing.	\$10,393	\$28,188
33	Hardness Testing -- Feasibility Study with Robotic Platform -- Phase II (M2011-006 Robotics Supporting Technologies, Phase IXb)	Invondane	This project will: (a) build a hardness tester integrated onto the Explorer 20/262 robotic platform for the inspection of natural gas unspiggable pipelines, able to carry out hardness testing from the interior of a pipeline, and (b) demonstrate the ability to carry out such a test at the specification standards met by portable hardness testers available in the market today.	This project has safety and economic benefits:  Reduce cost to carry out non-destructive testing of pipelines. The ability to carry out such non-destructive tests inline avoids hydro testing or expensive and disruptive excavations to carry out the same task from above ground.	The feasibility study was completed. The technology development and testing program has been outlined. The plan is to integrate the hardness tester module into the EXP 20/26 platform. The timing of this work depends on our success in finalizing the design and in finding a live field test site for testing the hardness test module. We are seeking testing sites from the NYSEARCH funders for work to be conducted in the summer or fall.	\$15,962	
34	Design, Construction, and Testing of Magnetic Flux Leakage (MFL) Sensor for Inspection of Bends in Unspiggable Pipelines - Phase VII-b	Invondane	The work proposed by Invondane involves: (a) the laboratory testing of bend inspection using the existing MFL sensors in order to validate the results of the numerical studies carried out in the feasibility study, (b) implementing design changes to the magnetic bars to improve bend inspection capabilities, (c) testing the new magnetic bars on Explorer 20/26, (d) developing the algorithms to handle the data from such inspections, and (e) developing the sizing routines for defects in bends. The proposed work scope is divided into five tasks.	This project has safety and economic benefits:  This project will allow us to add to the existing capabilities of the Explorer robots for the inspection of unspiggable pipelines.	The MFL sensor for bends will be initiated once the Explorer 6/8 MFL sensor concept and preliminary design is completed. The project is in conjunction with Explorer 6/8 MFL sensor projects.		\$43,254
35	Odor Detection Threshold Study (M2016-002)	Monell Senses Center	Complete a comprehensive review of the state-of-the-art methodology to measure natural gas odorants and mixtures and to determine with updated methods the range of detection and readily detectable (recognition) thresholds for mercaptans used in the natural gas distribution sector.	This project has a safety benefit:  Better understanding mercaptan level needed to be detectable (recognition). Promote a safe and reliable distribution system.	The first part of the program will be to perform a literature search to help with the development of tests protocols for the study. Further, Monell needs to build an olfactometer test apparatus that is specific to the data that is necessary for testing random individuals and gaining statistical confidence on the sensitivity and variability of where mercaptans are first sensed (threshold levels) and then at what concentration the mercaptans are sensed /recognized as being the presence of natural gas. The tests will be conducted on two mercaptan compounds and one mixture.		\$24,872
36	Standoff Gas Flow Imaging and Analysis System Proof of Concept (M2015-002)	SRI/FloViz	This is a feasibility study of the Schlieren Optical Imaging Technology and is designed to examine whether methane emissions quantification measurements can be performed.	This project has an economic benefit:  This will assist in prioritizing the repair of grade 3 leaks by their rate of emission and this leak rate information can also be used in prioritizing segments for main replacement programs.	The first part of the feasibility study that is ongoing focuses on traditional large-size Schlieren measurements to show the range of direct flow rate capabilities and in various conditions. The second part (after a GO/NO GO milestone) is designed to miniaturize the large optics from the Traditional system and once again show applicable measurements and imaging analysis on a more portable benchtop handheld system.		\$38,691



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37	Development & Testing of RFID Tag for Coiled PE Pipe (M2016-003)	Engie	The overall objective of the proposed program is to develop and test a helical antenna and signal processing system for RFID technology embedded on coiled PE pipes that work in all soil conditions. The goal of this work is to determine whether RFID technology, that is currently applied to straight segments of pipe, can be re-designed and effectively applied to PE coiled pipe as installed in trenchless applications.	Improved tracking of distribution pipeline information for integrity management and locating PE pipe.	NYSEARCH/Engie program is set up to design and test the RFID for PE coiled pipe and then determine if the technology is meeting specifications that are required by NYSEARCH funders in North America. If proof-of-concept is successful then a next phase would be planned for field testing. This RFID technology not only allows tracking and traceability of PE pipe but it serves as a PE pipe locator.		\$12,664
<b>Subtotal NYSEARCH Allocation</b>						<b>\$70,376</b>	<b>\$191,690</b>

**Other**

38	Temperature Study	Arizona State University (ASU)	To determine soil temperatures at burial depths for natural gas pipelines in Southwest Gas' operating territories and perform analytical and testing services regarding soils, underground temperature sensing, data gathering, data analysis and testing validation.	This project has a safety benefit.  Better understanding of operating temperature conditions of underground facilities. Promote a safe and reliable distribution system.	Southwest Gas (SWG) and ASU have been monitoring and collecting weather data since July 2014. There are four locations in Arizona-Tampe, Tucson, Yuma, and Bullhead City. Two locations in Nevada-Henderson and Carson City. One location in Barstow, California. The temperature sensors were placed at depths of 6-inch, 24-inch, 36-inch, and 42-inch below the pavement and dirt. Moisture sensors were installed at depths of 6-inch, 24-inch, and 36-inch below the pavement and dirt. Each temperature station is self-sufficient as dual solar panels are used to generate power for the Data loggers and the sensor reading are continuously taken at 5-minute intervals. Annual average temperatures at each site both dirt and pavement have been computed at each depth from July 2014 through July 2015. Data from all sites will be continuously monitored and downloaded weekly.	\$76,991	\$47,690
39	Joint Industry Project (JIP)- Improved In-Situ Determination of Pipe and Weld Properties	DNV-GL	The objective of the joint industry project is to evaluate the use of various field portable (in-situ) nondestructive analyses to determine strength and toughness of pipe base metal and seams (ERW and flash welded seams). The ability to nondestructively determine mechanical properties directly influences pipeline integrity assessments (i.e., significance of flaws) and supports confirmation of MAOP validity when records are incomplete or not verified.	This project has safety and economic benefits.  Reduce the cost in determining the pipe material properties (e.g., strength) of steel pipe for pipeline integrity purposes.	The work builds upon the results of a prior JIP that validated the ability to use of hardness test data from field portable testers to determine the lower bound of expected pipe base metal yield strength. The results indicate that by considering multiple data sets consisting of hardness data, steel composition, and steel microstructure some estimates of toughness for both the base metal and seams are possible. The same types of data can provide improved ability to estimate the yield strength of base metal and seams. A draft final report has been issued for review by JIP members.	\$14,161	
40	Keyhole Tool Fastrack	Timberline Tool	The objective of this proposal is to fastrack the development of a group of PE pipe tools for Southwest Gas Corporation to be used in keyhole excavation operations.	This project has safety and economic benefits.  Improved safety in performing installation and maintenance of PE pipe while using key hole method for accessing the pipe.	Timberline designed & manufactured working keyhole prototypes of a 3" sleeving cutter, a 1/2"-1" pipe cutter tool, and camera insertion tool. Timberline will continue to work towards refining these prototypes based on feedback from SWG.	\$17,976	
41	Picarro Surveyor Field Trial	SWG	To evaluate the use of Picarro Surveyor system for determining leaks. Picarro will provide the equipment, training, driving protocol and assist in the validation process.	This project has safety and economic benefits.  Improved accuracy in pinpointing hard to find leaks. In addition, reduced costs in pinpointing leaks.	Field evaluations have taken place from the 3rd quarter of 2015 through the 1st quarter of 2016. The evaluations have demonstrated that the technology is able to find leaks. Analysis of the data and processes utilized during the field trials will be completed in the 2nd quarter of 2016. Based on this analysis, further field trials may be conducted.	\$110,052	
<b>Subtotal Other Allocation</b>						<b>\$219,180</b>	<b>\$47,690</b>
						Apr. '15 - Mar. '16 Funding	Apr. '16 - Mar. '17 Funding
Total Dollars Allocated						\$688,712	\$688,712
Total Available Research Dollars						\$688,712	\$569,535
Available Dollars						\$0	-\$119,177

**General Notes:**

- 1) Total authorized collection in Final Order is \$688,712 per year. Funding is collected in a deferred balancing account.
- 2) Proposed projects reflected in current or proposed funding year may change. Some projects may terminate pending progress or proposed projects may not materialize due to lack of support. In addition, research organizations meet and discuss new and existing projects at various times of the year - this document reflects projects and information as of the date of this document.
- 3) Actual allocation amount may change due to changes in projects described in item #2 above or due to number of companies that ultimately fund a project.
- 4) Southwest anticipates using all available dollars as appropriate R&D project proposals are received.